Semi-Annual Progress Report

Send progress report to:

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General Information

Contract / Grant Agreement Number: IAA No. C2200192

Project Title: **The effectiveness of trees in mitigating storm-water runoff in Western Washington (Phase II)**

Organization: Washington Department of Natural Resources

Project Manager: Abby Barnes

Reporting Period: April 1, 2023 to December 31, 2023

Date this Form was Completed January 16, 2024

Brief description of Tasks and Deliverable Achievements for current report period.

Task 1: Phase I Factsheet development

Percent of Task Completed:	100%					
All deliverables to be completed:	**Deliverables 1.1**					
Deliverables completed in **previous**	none to report					
Deliverables completed in **this** reporting period:	Deliverable 1.1					
Description of Achievements:	Factsheet was completed, submitted and approved					
Challenges faced:	none to report					

Task 2: Project Management

Percent of Task Completed:	60%				
All deliverables to be completed:	**Deliverables 2.1 to 2.3:** Semi Annual reports #s 1 to 3				
Deliverables completed in **previous** reporting periods:	Deliverable 2.1				
Deliverables completed in **this** reporting period:	Deliverable 2.2 (this report)				
Description of Achievements:	1. A technical advisory committee (TAC) of 3 members was formed in early 2023. 2. The TAC received a draft version of the Quality Assurance Project Plan.				
Challenges faced:	none to report				

Task 3: Quality Assurance and Project Protocol (QAPP) development				
Percent of Task Completed:	100%			
All deliverables to be completed:	Deliverable 3.1 & 3.2: Draft and final QAPP			
Deliverables completed in **previous** reporting periods:	Deliverable 3.1: Draft QAPP Deliverable 3.2: Final QAPP			
Deliverables completed in **this** reporting period:	none to report			
Description of Achievements:	Project QAPP was completed, sent to the TAC for their approval, revised, and approved by SAM Coordinator			
Challenges faced:	none to report			

Task 4: Instrument Installation and Monitoring					
Percent of Task Completed:	100%				
All deliverables to be completed:	**Deliverable 4.1:** Memo of completed instrumentation				
Deliverables completed in **previous** reporting periods:	Deliverable 4.1: Memo of completed instrumentation				
Deliverables completed in **this** reporting period:	none to report				
Description of Achievements:	1. Trees instrumented with static sapflux monitoring sytems. 2. Soil moisture sensors were installed at sites 1 and 2 3. Throughfall interception gages installed under six tree canopies. 4. Mobile sap flux sensors and mobile soil moisture gages were successfully prototyped and installed. 5. Weather stations installed, tested, and functional. 6. Instrumentation memo was written.				
Challenges faced:					

Task 5: Instrument Maintenance and Data Downloads					
Percent of Task Completed:	50%				
All deliverables to be completed:	**none**				
Deliverables completed in **previous**	none				
Deliverables completed in **this**	none				
Description of Achievements:	Initial deployments and data downloads have begun. A short summary of data collected are shown below.				
Challenges faced:					

Task 6: Data Analysis, Process and Submittal					
Percent of Task Completed:	0%				
All deliverables to be completed:	**Deliverable 6.1:** Copy of data in Excel format				
Deliverables completed in **previous** reporting periods:	none				
Deliverables completed in **this** reporting period:	none to report				
Description of Achievements:	none to report				
Challenges faced:	none to report				

Task 7: Final Tree Study Phase II Report					
Percent of Task Completed:	0%				
All deliverables to be completed:	**Deliverable 7.1:** Draft report of the whole study **Deliverable 7.2:** Final Report				
Deliverables completed in **previous** reporting periods:	none				
Deliverables completed in **this** reporting period:	none to report				
Description of Achievements:	none to report				
Challenges faced:	none to report				

Task 8: Outreach and Communication					
Percent of Task Completed:	0%				
All deliverables to be completed:	**Deliverable 8.1:** Presentation to the Stormwater Work Group **Deliverable 8.2:** Draft fact sheet per SAM format				
Deliverables completed in **previous** reporting periods:	none				
Deliverables completed in **this** reporting period:	none to report				
Description of Achievements:	none to report				
Challenges faced:	none to report				

Introduction

This short narrative covers the period of sap flux data collection from three species of trees using mobile sap flux probes. Twenty trees were probed, and sap flux measured over two-day periods. Data shown here are only from mobile probes, we are also collecting continuous data (every 30 minutes) from 20 trees instrumented at two fixed stations on The Evergreen State College (TESC) campus.

Average daily weather conditions over time

Weather conditions are being monitored at three locations – specifically rainfall, dew point, photosynthetically active radiation (PAR), solar radiation, leaf wetness, temperature, humidity, and pressure. Vapor pressure deficit (VPD) was then calculated from temperature and humidity data. Weather data show the long dry summer, with rain events beginning in late August 2023. Late August is also when PAR and VPD start to decline as the rainy season sets in (Figure 1).

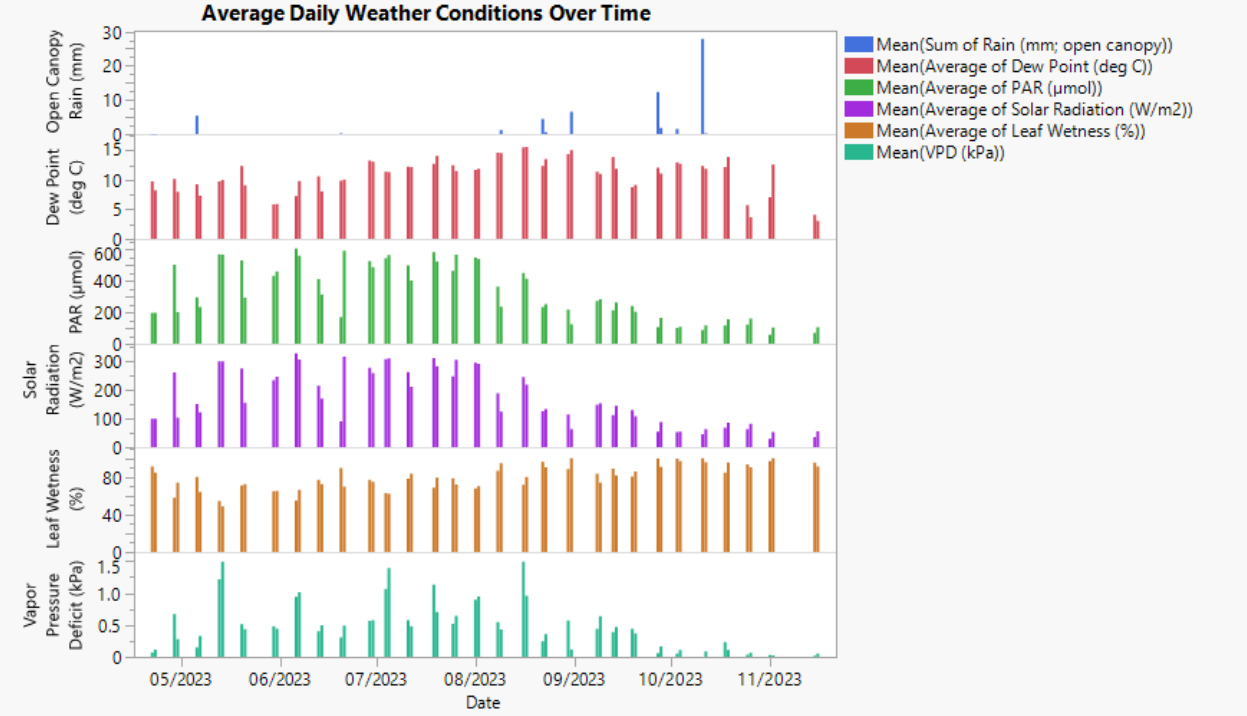

Figure 1: Daily averages for days when trees were measured for transpiration (sap flux) rates. Open canopy rainfall (blue), dew point (red), photosynthetically active radiation (PAR; green), solar radiation (purple), leaf wetness (orange), and VPD (teal) are displayed over time. Each tick mark on the horizontal axis represents the beginning of each month.

Sap velocity over time by species

Sap velocity for three species – Red Maple, Honeylocust, and Doug Fir - were measured using mobile sap flux sensors over two-day measurement intervals. Ten Douglas-fir trees, seven red maple trees, and three honey locust trees were measured over 2-day intervals between April 2023 and December 2023. Sap velocity data show highest values in June and July for all Red Maple and Doug Fir, while the highest sap velocities for honey locust were measured in May when we began the 2023 sampling campaign (Figure 2).

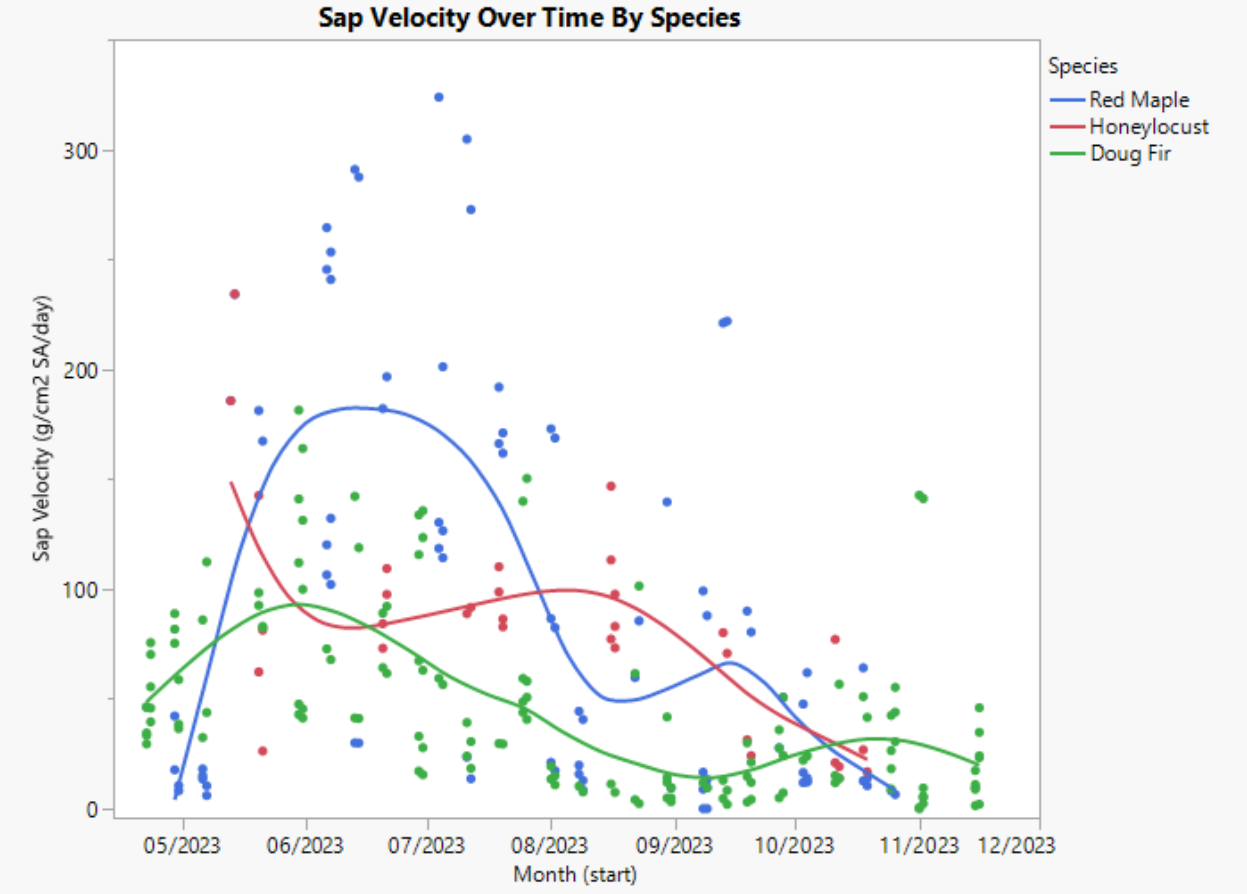

Figure 2: Sap velocity for Red Maple (blue), Honeylocust (red), and Douglas Fir (green) are shown over time. Lines represent spline moving-average fits to the data for each species. Each tick mark on the horizontal axis represents the beginning of each month.

Sap velocity as a function of seasonal vapor pressure deficit

Using weather station variables to predict transpiration patterns was an important goal during phase II of this project. Preliminary comparison of sap velocities to variation in VPD suggest that early in the growing season and across all tree species, sap velocities are the most responsive to changes in VPD. In other words, small changes in VPD are accompanied by the highest increase in sap velocities (left-most panel in Figure 3). The relationship between sap velocities and VPD changed through the growing season with sap velocities not being as responsive to changes in VPD (right-most panel in Figure 3). For Doug Fir data, there appears to be a negative relationship between VPD and sap velocity in the late growing season represented by the green line in the right-most panel in Figure 3.

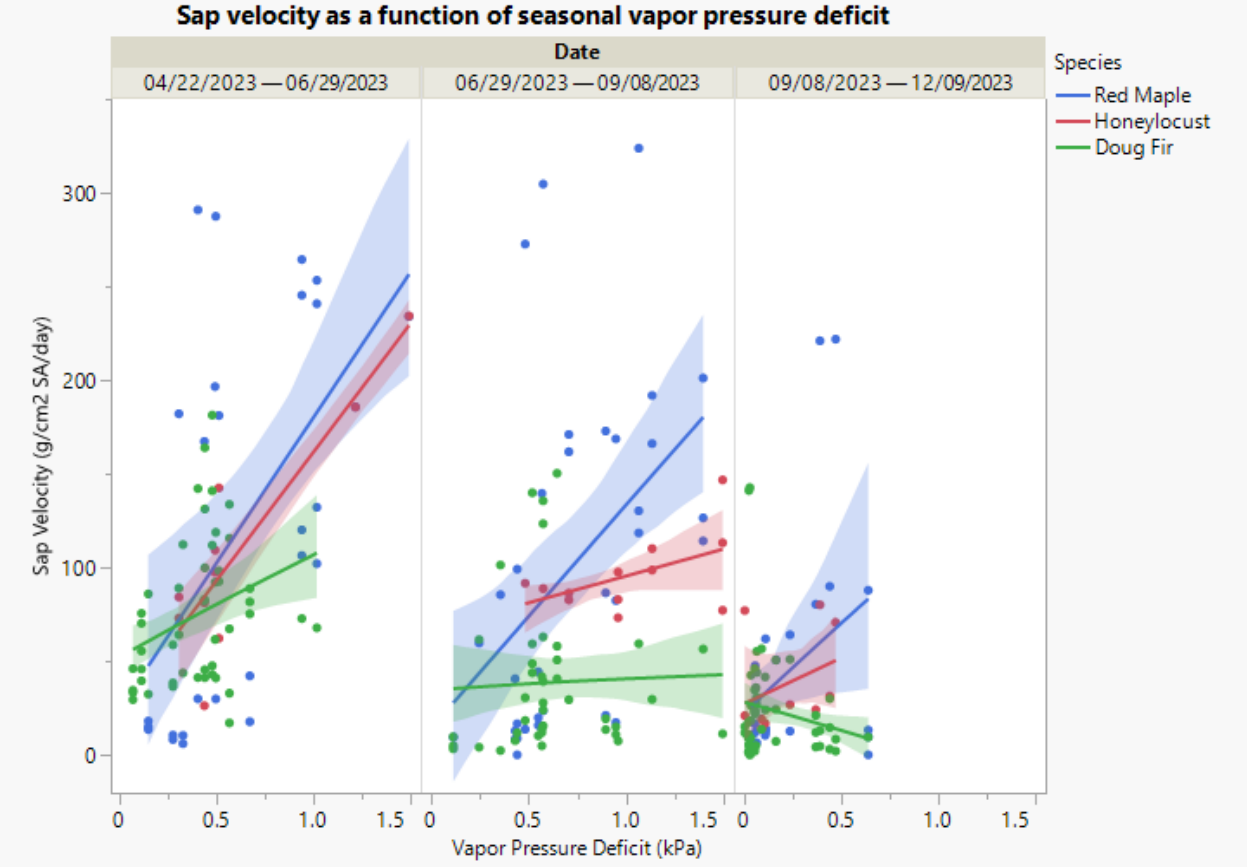

Figure 3: Sap velocity is plotted as a linear function of seasonal vapor pressure deficit with fit confidence (95%; shaded areas) where each of three bins represents approximately two months between April 22 and December 31, 2023.